A.D. 1877, 20th JANUARY. N° 270.

Apparatus for Generating Electricity.

LETTERS PATENT to Cromwell Fleetwood Varley, of No. 2, Great Winchester Buildings, in the City of London, Engineer, for the Invention of "IMPROVEMENTS IN APPARATUS FOR GENERATING ELECTRICITY."

Sealed the 15th June 1877, and dated the 20th January 1877.

PROVISIONAL SPECIFICATION left by the said Cromwell Fleetwood Varley at the Office of the Commissioners of Patents on the 20th January 1877.

CROMWELL FLEETWOOD VARLEY, of No. 2, Great Winchester Buildings, in the City of London, Engineer. "IMPROVEMENTS IN APPARATUS FOR GENERATING ELECTRICITY."

This Invention has for its object the production of electricity by which electrostatic discharges and dynamic currents of sufficient potential to generate ozone produce chemical decomposition, the electric light and other electrical effects can be obtained, and further to maintain the discharges, currents, or interchange of potentials between the poles of the electro-dynamic machine uninterrupted, and especially when this Invention is employed for producing the electric light to maintain the light as constant as possible.

The first part of the Invention consists of a self-charging electro-magneto machine which may for special purposes have permanent instead of electro-magnets by which currents of any desired degree of electro-motive force can be generated by mechanical energy.

The second part of the Invention is an improvement upon the machine described by me in my Patent, No. 206, A.D. 1860, by which accumulating charges are stored up upon inductive surfaces and on rotary dielectrics, and which are capable of giving off sparks of considerable length; these electrostatic discharges or sparks are employed to re-establish the circuit between the carbon points when accidentally or momentarily interrupted.

The principle of the magneto machine and chief features of novelty in my Invention mainly consists in maintaining actual or nearly actual contact between the armatures and poles of the inducing magnets. The magnets themselves

together with the intermediate cores surround by helices form complete circuit or circuits of iron, or iron and steel, or other magnetic substances, so that the magnetic poles of the permanent or electro-inducing magnets have their respective north and south poles continuously or nearly continuously closed notwithstanding the movement of the armature or armatures, but which armature or armatures when rotated or moved to or fro along the iron ring or link included in or forming part of the continuous magnetic circuit, effect the commutation, or in other words alter the direction of the magnetic conduction through the inducing cores surrounded by electric conductors; the effect of which commutation is to generate electricity in the conductors forming the helices. The armatures being in actual or nearly actual contact with the inducing magnets insure a more perfect magnetic conduction through the intermediate cores with which the inducing magnets form an unbroken circuit of iron or steel or other magnetic substance, in order that as large a per centage as possible of the work done in giving motion to the machine shall be converted into electric energy.

In arranging a machine according to my Invention in the simplest and most elementary form I employ two horse-shoe magnets; I place them opposite the one to the other, and between their poles I place two soft iron cores on which coils of covered wire are wound. The two north poles of the magnets are in contact with the two ends of one of the cores, and the two south poles are similarly placed in relation to the other core. Together with these, which are fixed parts of the apparatus, I employ an armature to which a reciprocating motion is communicated which places it first in contact or nearly so with the two poles of one magnet, and then transfers it to a corresponding position in respect to the other magnet. The faces of the magnets and of the armature may advantageously be grooved to increase the area of the surfaces in contact or close proximity. The armature may also advantageously be made double so that the poles of the magnets may be received between its two parts. The attraction of the magnet for the two parts of the armature will then balance each other, and by a screw adjustment the surfaces of the armature may be brought very close to the surfaces of the magnets without giving rise to friction. Or rollers of non or a magnetic material may be employed for this purpose. In place of a reciprocating armature a rotating armature may be employed, so formed as to connect the north pole of one magnet with the south pole of the other, and as it rotates to couple the poles alternately.

According to another arrangement I employ six or it might be any other number of horse-shoe magnets arranged radially around a circle, and with, say, the north poles of all the magnets uppermost. As in the former case the similar poles of the magnets are connected by means of soft iron cores wound with covered wire forming the circuit in which the currents are generated. These, which are the stationary parts of the apparatus, are all preferably carried upon a gun metal cylinder or ring, within which a corresponding plug or frame rotates; this plug or frame carries armatures, and as the plug revolves these couple together the poles of each magnet in succession. I employ one armature for each alternate pair of magnetic inducing poles of which the series is composed.

The electrostatic multiplier referred to as the second part of this Invention comprises, as in my Patent, No. 206, A.D. 1860, a series of insulated studs or conductors which act as potential carriers, and enable the tension which on first starting may be so minute as to be imperceptible, to be augmented in the same manner as described in my Patent before mentioned, but in addition to which I employ surfaces or discs of a dielectric substance such as a plate or cylinder of glass, vulcanized caoutchouc, together with inductive surfaces placed on the reverse side to the collecting and discharging combs or contact pieces, by which means a succession of sparks or electro-static discharges can be maintained. The charging-up or accumulation of the electro-static potential is effected automatically, and as well as the former part of the Invention is or may be self-charging.

During the operation of charging-up contact making springs or contact pieces

are employed to make contact with the carriers. As soon as a charge of a certain potential has been accumulated these springs are no longer required, and I remove them or throw them out of action.

SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said Cromwell Fleetwood Varley in the Great Seal Patent Office on the 20th July 1877.

CROMWELL FLEETWOOD VARLEY, of No. 2, Great Winchester Buildings, in the City of London, Engineer. "IMPROVEMENTS IN APPARATUS FOR GENERATING ELECTRICITY."

This Invention has for its object the production of electricity by arrangements of apparatus by which electrostatic discharges and dynamic currents of sufficient potential to generate ozone, produce chemical decomposition, the electric light and other electrical effects can be obtained. And further to maintain the discharges, currents, or interchange of potentials between the poles of the electro-dynamic machine uninterrupted and especially when this Invention is employed for producing the electric light to maintain the light as constant as possible.

The first part of the Invention consists of a magneto-electric machine which may for special purposes have permanent instead of electro-magnets, by which currents of any desired degree of electro-motive force can be generated by mechanical energy.

The second part of the Invention is an improvement upon the machines described by me in my Patent, No. 206, A.D. 1860, by which accumulating charges are stored up upon inductive surfaces and on rotary dielectrics, and which machines are capable of giving off sparks of considerable length. These electrostatic discharges or sparks are employed when electricity is employed to produce light, to re-establish the circuit between the carbon points when accidentally or momentarily interrupted.

In magneto machines constructed according to my Invention, actual or nearly actual contact is maintained between the armatures and poles of the inducing magnets. The magnets themselves together with the intermediate cores surrounded by helices, form a complete ring, link, or circuit (or circuits) of iron or iron and steel or other magnetic substances. The permanent or electro-inducing magnets have their respective north and south poles continuously or nearly continuously closed, notwithstanding the movement of the armature or armatures, but the armature or armatures (when rotated or moved to or fro along the iron or link) effect the commutation, or in other words, alter the direction of the magnetic conduction through the inducing cores surrounded by electric conductors; the effect of which commutation or reversal of magnetism is to generate electricity in the conductors forming the helices.

In arranging a machine according to my Invention in the simplest and most elementary form, I employ two horse-shoe magnets; I place them opposite the one to the other, and between their poles I place two soft iron cores on which coils of covered wire are wound. The two north poles of the magnets, are in contact with the two ends of one of the cores, and the two south poles are similarly placed in relation to the other core. Together with these, which are fixed parts of the apparatus, I employ an armature to which a reciprocating motion is communicated which places it first in contact or nearly so with the two poles of one magnet and then transfers it to a corresponding position in respect to the other magnet. The faces of the magnets and of the armature may advantageously be grooved to increase the area of the surfaces in contact or close proximity. The armature may also advantageously be made double so that the poles of the magnets may be received between its two parts. The attraction of the magnet for the two parts of the armature will

then balance each other, and by a screw adjustment the surfaces of the armature may be brought very close to the surfaces of the magnets without giving rise to friction. The dimensions of the armature should be such that it may close with one pair of poles before leaving the other pair of poles. In place of a reciprocating armature a rotating armature may be employed, so formed as to connect the north pole of one magnet with the south pole of the other, and as it rotates to couple the poles alternately.

According to another arrangement I employ six or it might be any other even number of horse-shoe magnets arranged radially around a circle and with, say, the north poles of all the magnets uppermost. As in the former case the similar poles of the magnets are connected by means of soft iron cores wound with covered wire forming the circuit in which the currents are generated. These, which are the stationary parts of the apparatus, are all preferably carried upon a gun metal cylinder or ring, within which a corresponding plug or frame rotates; this plug or frame carries armatures, and as the plug revolves these couple together the poles of each magnet in succession. I employ one armature for each alternate pair of magnetic inducing poles of which the series is composed.

In some cases to produce currents for telegraphic and other uses I give motion to the armature by a finger key when it is desired to transmit a current. In arrangements of this nature I make the armature of small size and I furnish the magnets with pole pieces or horns approaching within a short distance the one of the other, leaving only sufficient space for the armature to move between them For some purposes I mount the armature on a tuning fork and so obtain electric pulsations in unison with the fork. Other vibrators may be substituted for the fork.

Figures 1 to 14 illustrate the arrangement of apparatus according to this part of my Invention. In Figure 1 M and M^1 are horse-shoe magnets; permanent magnets are represented but electro-magnets are also available. Between the magnets and in contact with them are two cores of soft iron wound with coils of insulated wire C, C^1; they form part of the circuit or circuits in which the electricity generated by the apparatus is transmitted. N, S, and N^1, S^1, mark the poles of the magnets M and M^1. O, O, are guides made of gun metal in which the rod D is free to slide to and fro; it has upon it the armature of soft iron marked A. A reciprocating movement may be communicated to the armature between the guides O by connecting the rod D directly or indirectly with a steam engine or other motor. It will be observed that in this arrangement no reversal of the magnetism in the armature A takes place.

Figure 2 shows an arrangement similar to Figure 1, but with the faces of the magnets and of the armature grooved to increase the area of the surfaces in close proximity.

Figure 3 is a section on the line 1, 1, in Figure 2. I also in some cases form the armature in two parts, one above and the other below the poles of the magnets, and with a gun metal block B between them, as is shewn in Figure 4.

Figure 5 represents an arrangement in which a number of armatures are mounted upon a rotating disc of gun metal, and they are so placed that as the disc rotates they close the poles of the two magnets alternately. Figure 6 shows the same arrangement in another form. In Figure 7 the armature is mounted upon a rotating axis D, and as it revolves it alternately closes the pole N with S^1 and N^1 with S. In this arrangement the magnetism in the armature A is reversed in each rotation, and the armature may carry a coil C^2, in which case electricity will be generated in the circuit of which this coil forms part. An ordinary rotating commutator may be included in the circuit and the electricity can then be employed to excite the magnets M, M^1, when electro-magnets are employed. Figures 8 and 9 show a similar arrangement in a different form.

The arrangements above described are suitable for use for the production of electric light and such like purposes.

Figures 10 and 11 show an apparatus in which electric currents for telegraphic

or such like use are produced by the depression of a finger key. The magnets in this case are furnished with horns in close proximity the one to the other so that the armature may be small and its motion short.

Figure 12 shows a similar arrangement in which the size of the armature is further reduced so that it may be carried upon the prongs of a tuning fork and made to generate shocks which can be applied at a distance to excite a vibrating apparatus and cause it to emit a sound corresponding to the note of the original tuning fork.

Figure 13 shows the way in which the apparatus may be applied to relay currents which follow one another in rapid succession; the armature is here supported by strained wires. The currents to be relayed pass in the coils C, C^1, and cause motion in the armature; K and L are platinum contact points; H is a local battery; and I is a receiving instrument. The same apparatus may also be used as a sounder, the armature being then connected with a diaphragm, which will thus be caused to vibrate in unison with the fork or vibrator.

Figure 14 shows another form of apparatus arranged according to my Invention for generating electricity; M, M, M, are a series of horse-shoe magnets of which (the Figure being a plan) only the upper limbs are seen, the same pole, say, the north pole, is uppermost in each case, and it is armed with a soft iron pole piece marked N, N. These pole pieces (and the similar pole pieces for the south poles of the magnets which are immediately underneath the pole pieces N, N,) are let into a gun metal cylinder or ring B, which may if desired be cast upon the iron pole pieces. The pole pieces N, N, are connected the one with the other by soft iron cores, upon which coils of insulated wire C, C, C, are wound, and the arrangement is in all respects similar in connection with the lower series of pole pieces in contact with the south poles of the magnets. The coils may all form part of one circuit, or there may be two or more circuits, as in each case may be most convenient. A, A, A, are the armatures; they are all mounted in a plug or frame which is arranged to rotate within the ring B, so that the armatures may pass in close proximity to the poles of the magnets. The armatures as they pass in succession cause the magnetism in the cores of the coils C to change its direction as in the other arrangements, and alternating currents are produced in the circuit or circuits. A commutator may be employed to cause the currents to flow in one direction if necessary.

The electrostatic multiplier referred to as the second part of the Invention comprises, as in my Patent No. 206, A.D. 1860, a series of insulated studs or conductors which act as potential carriers, and enable the tension, which on first starting may be so minute as to be imperceptible, to be augmented in the same manner as described in my Patent before mentioned, but in addition to which I employ surfaces or discs of a dielectric substance, such as a plate or cylinder of glass or vulcanised caoutchouc, &c., together with inductive surfaces placed on the reverse side to the collecting and discharging combs or contact pieces, by which means a succession of sparks or electrostatic discharges can be maintained. The charging up or accumulation of the electrostatic potential is effected automatically, and as well as the former part of the Invention is self charging.

During the operation of charging-up, contact making springs or contact pieces are employed to make contact with the carriers. As soon as a charge of a certain potential has been accumulated these springs are no longer required, and I remove them or throw them out of action.

The electrostatic multiplier, as I prefer to construct it, consists of a vulcanite disc mounted upon an axis carried upon insulating standards, and capable of being rapidly rotated. On the face of the disc I fix strips of tin foil radially and at distances apart. In front of the disc, and diametrically opposite the one to the other, are the two collecting combs by which the electricity passes from the face of the disc to the conductors of the machine. As the disc revolves the strips of tin foil pass in succession in proximity to the collecting combs. Also in close proximity to the disc, but on the other side of it, are two pieces of wood mounted on insulating

standards and serving as the inductors; they are about the same width, or somewhat wider than the collecting combs. They are of curved form, each inductor covering about a quadrant of the operative part of the disc or that which passes near the points of the collecting combs, and upon which part on one side of the disc are the strips of tin foil. The inductors are so fixed upon their insulating supports that the leading end or commencement of the inductor is immediately opposite to the collecting comb, but on the other side of the disc.

For the purpose of charging the inductors there are other combs similar to the collecting combs and similarly placed, but removed from them by an angular distance of ninety degrees, so that they are opposite to the ends of the inductors but on the other side of the disc. These combs are placed in metallic connection with the inductors, each to each. To render the machine self-charging, the last mentioned combs also carry springs or wire brushes, which make metallic contact with studs upon the face of the disc and in metallic contact with the tinfoil strips upon it, each to each. As soon as the machine is at work these springs or brushes can be lifted out of contact by means of silken threads or other convenient attachments.

In the annexed Drawings Figure 15 is a front elevation, and Figure 16 is a plan of my electro-static multiplier; A is the vulcanite disc on an axis B carried by insulating standards. The axis has upon it a pulley which receives a driving cord from a wheel which is rotated by hand; A^1, A^1, are tinfoil strips fixed upon the face of the disc, and A^2, A^2, are studs in metallic connection with the strips A^1; C, C, are metallic collecting combs, and D, D, are the inductors; both are carried upon insulating standards; E, E, are the combs for charging the inductors; they also are insulated, and they are connected by the covered wires E^1, E^1, with the inductors; E^2, E^2, are the springs or wire brushes for making contact with the studs A^2. The contact is made when a finger key (not shown) is depressed. The key acts through silken cords which draw the brushes or springs forward; when the key is liberated they move back out of contact.

I employ magneto-electric machines and my electrostatic multiplier in combination in the production of electric light. I cause an electric arc to be formed between carbon points by the magneto-electric machine, as is well understood, and in order to render the light constant I apply the electrostatic multiplier. I place its conductors near the carbon holders, so that a stream of sparks may pass to them constantly so long as the light is being maintained. The high tension electricity, which in this manner is caused to pass between the carbon points, effectually maintains the magneto-electric discharge.

Having thus described the nature of my said Invention and the manner of performing the same, I would have it understood that I claim,—

First. The construction of magneto-electric machines with stationary magnets, coils, and cores, the magnets and cores forming a closed link or links, and the armature moving in such manner as to cause a reversal in the direction of the magnetism in the cores, substantially as described.

Second. The construction of magneto-electric machines, substantially as described.

Third. The construction of the electrostatic multiplier, substantially as described.

Fourth. The combination of the magneto-electric machine and the electrostatic multiplier in the production of electric light, substantially as described.

In witness whereof, I, the said Cromwell Fleetwood Varley, have hereunto set my hand and seal, this Twentieth day of July, in the year of our Lord One thousand eight hundred and seventy-seven.

C. F. VARLEY. (L.S.)

LONDON: Printed by George Edward Eyre and William Spottiswoode, Printers to the Queen's most Excellent Majesty. 1877.

A.D. 1877. Jan. 20. Nº 270.
VARLEY'S Specification.

(3 SHEETS)
SHEET 1.

FIG. 1.

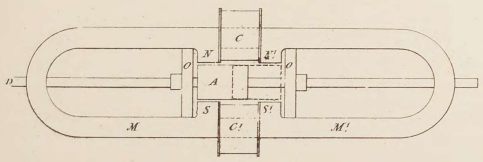


FIG. 2.

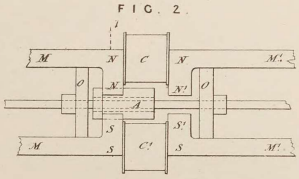


FIG. 3.

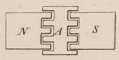


FIG. 4.

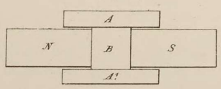


FIG. 5.

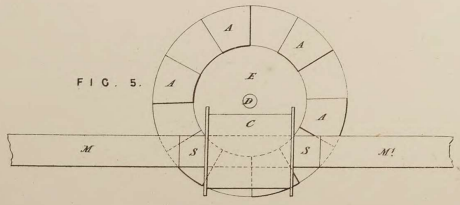


FIG. 6.

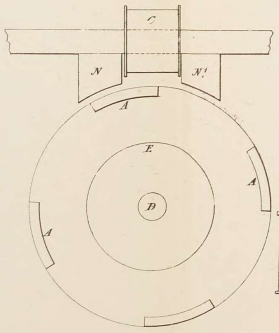


FIG. 7.

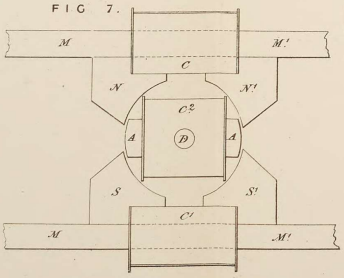


FIG. 8.

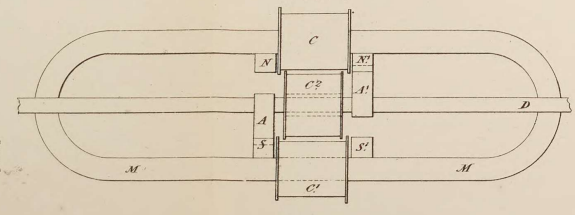


FIG. 10.

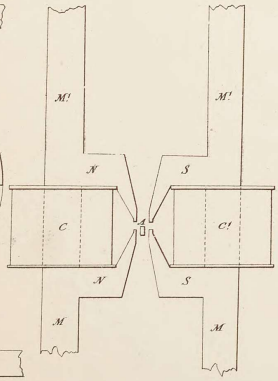


FIG. 11.

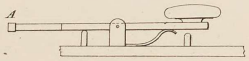


FIG. 12.

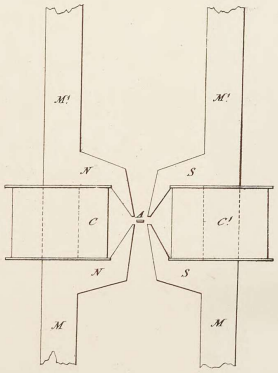
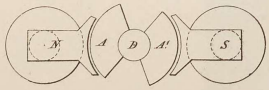


FIG. 9.



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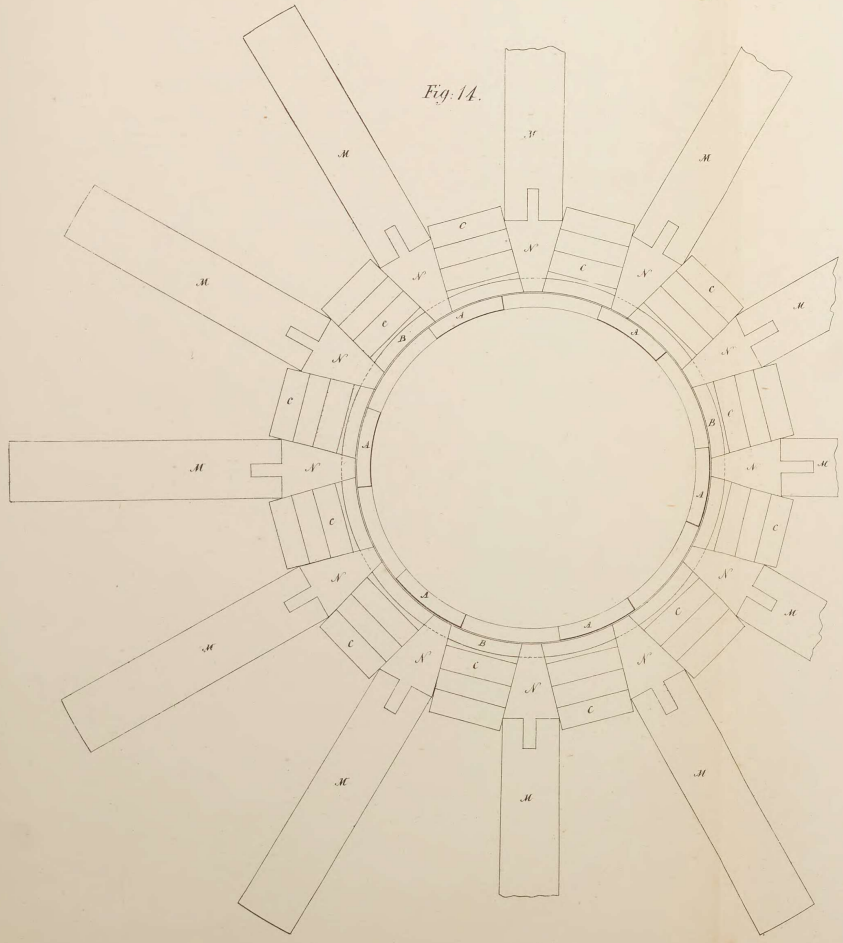
VARLEY'S Specification.

(3 SHEETS)
SHEET 2.

Fig. 14.



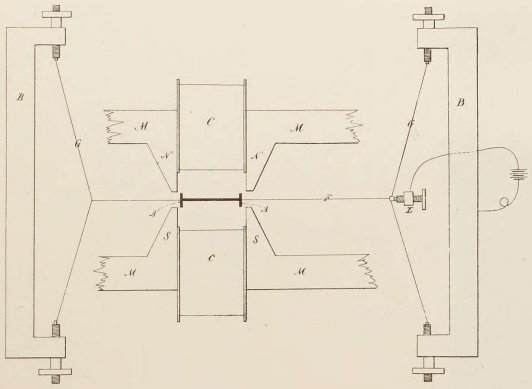


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FIG. 15.

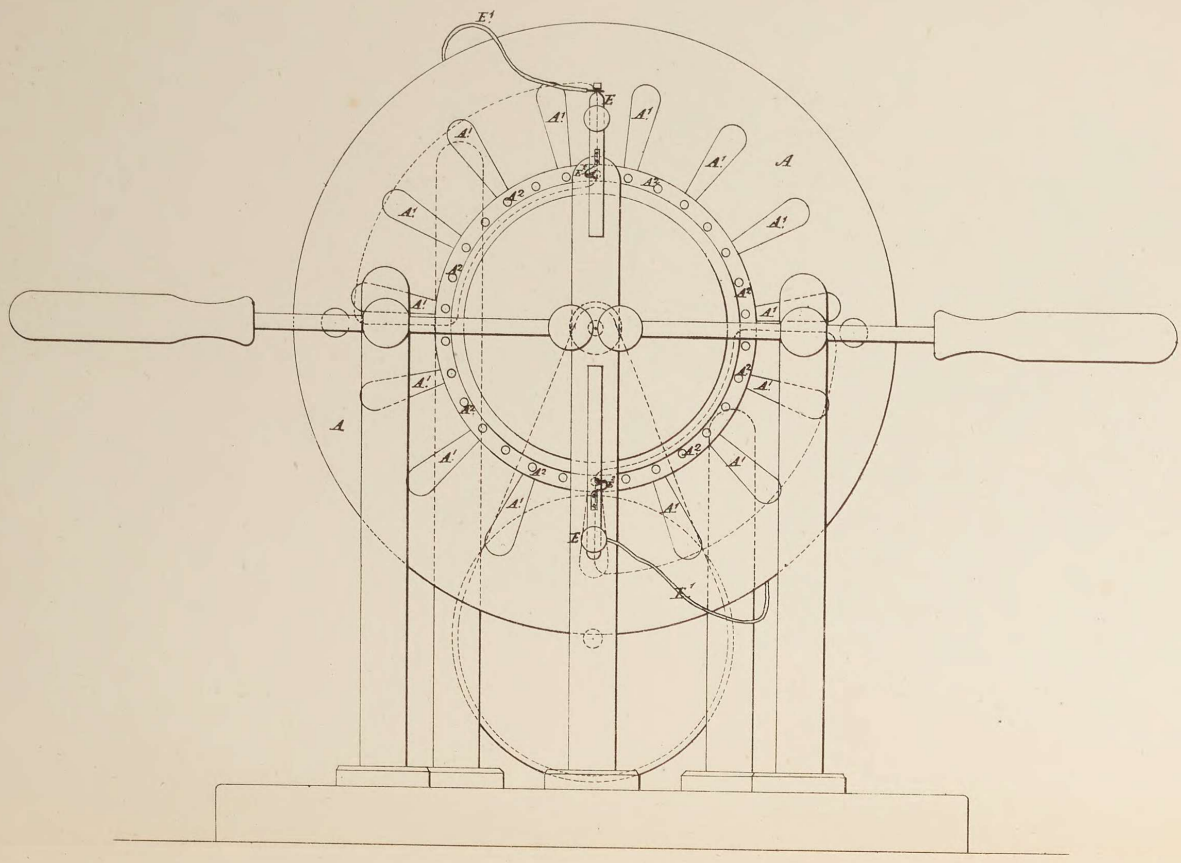
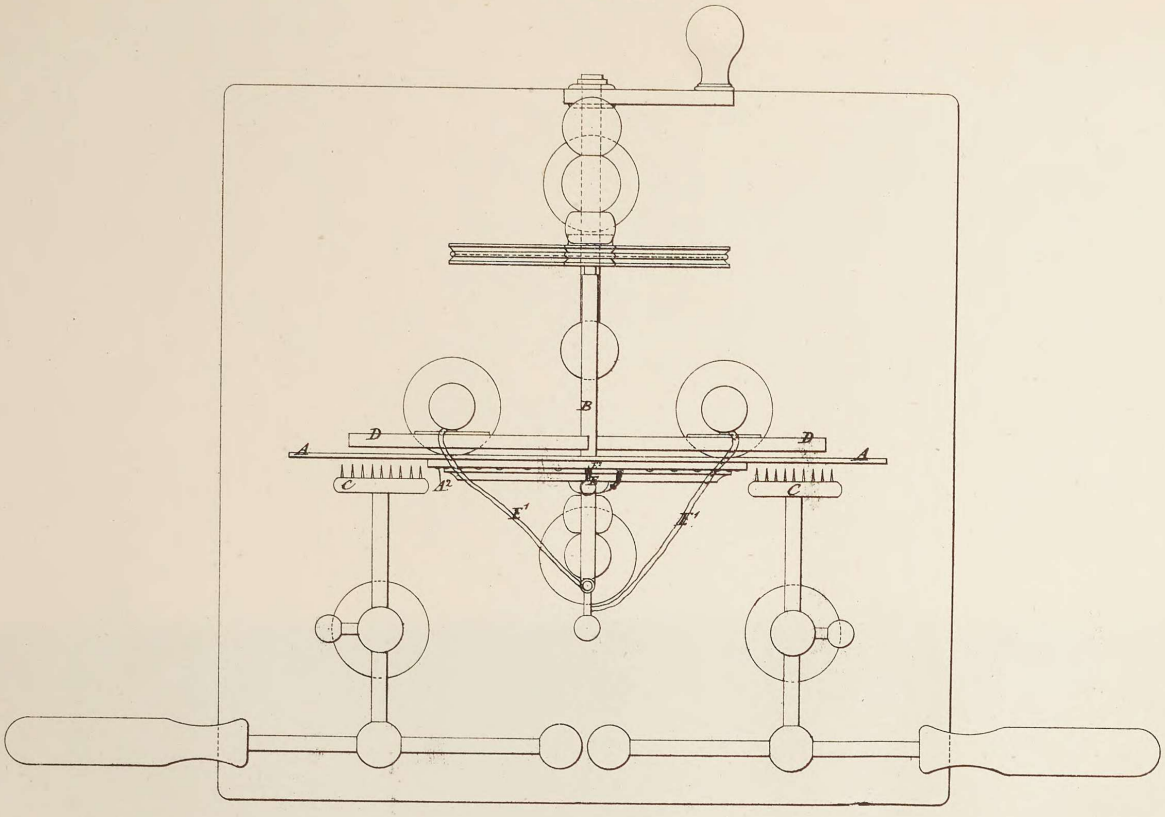


FIG. 16.



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